Government Created Markets, Competition and Welfare:

The Case of Medicare HMOs

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Abstract

In this paper we estimate the welfare associated with the Medicare HMO program, now known as Medicare+Choice (M+C). We find that the M+C program contributed over $6.0 billion (1998 dollars) to consumer and producer surplus from 1993 to 1999. We estimate that the HMO program generates positive net societal welfare only if the cost of treating HMO enrollees in the Medicare FFS plan is not less than 96% of the average Medicare payment to HMOs. Thus, it is likely that the M+C program, as currently constituted, results in societal welfare loss. Increases in the government payment subsidy to HMOs are estimated to result in a net welfare loss of approximately 20%. A $1 increase in government subsidy expenditure is expected to increase consumer welfare by 3 cents and increase HMO profits by 76 cents. The ratio of the increase of Medicare beneficiary surplus to HMO profits decreases in the number of plans operating in a county. Finally, the ratio of the increase in consumer plus producer surplus divided by the increase in government expenditures associated with increasing the payment rate is decreasing in the number of plans operating in a county.

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1. Introduction

Economists have long been suspicious of the ability of the government to provide goods or services. The argument is quite simple. Government lacks the duel disciplining forces of the profit motive and competition to drive it to provide the efficient quality and/or quantity at the appropriate price of any good or service. This skepticism of the government's abilities has lead economists (and others) to propose that the government set up markets for those services that are deemed so important that each citizen should not be limited by income in their consumption of the good. The idea is that the government provides a voucher (or some other subsidy) to consumers and firms (profit maximizing or not-for-profit organizations) would compete to provide the service to those consumers. It is argued that the competition between organizations would compel firms to provide the efficient level of quality at a price that approaches marginal cost. Recent proposals to reform public education and Medicare have this structure. In this paper, we explore how effective one government created market, HMOs for Medicare eligibles, is in creating competition and welfare.

In 1982, Congress passed the Tax Equity and Fiscal Responsibility Act (TEFRA), which mandated the provision of managed care plan options to Medicare beneficiaries. Under the statue, the Health Care Financing Administration (HCFA), now called the Center for Medicare and Medicaid Services (CMS), was directed to contract with health maintenance organizations (HMOs) to provide a managed care option to Medicare enrollees. In Medicare+Choice (M+C), the current name for the program, Medicare enrollees can forgo the traditional Medicare insurance program and enroll in a qualified HMO. The HMO agrees to provide health insurance that covers all Medicare-covered services (Parts A and B) for the enrollee in exchange for per capita fee from CMS. In addition, HMOs are free to offer benefits in addition to those available to Medicare beneficiaries under the standard, fee-for-service (FFS) program. The rationale underlying the TEFRA is that HMOs may be more efficient at providing care thereby reducing the federal Medicare expenditures.[1] Medicare beneficiaries would also benefit from being able to

[1] There is some evidence indicates that the in fact this initiative cost the government the HMO attracted the healthier and therefore the cheaper Medicare enrollees.

choose from several competing HMOs who presumably would offer a benefit package that are more generous than available in the traditional fee-for-service program thereby saving on out-of-pocket expenditures.

We exploit the institutional properties of the Medicare HMO market and use a high quality, plan/market-level data set to estimate the welfare Medicare beneficiaries receive from being able to enroll in HMOs. We use methods suggested by Berry (1994) and Ackerberg and Rysman (2001) to estimate the preferences Medicare beneficiaries have over differentiated HMOs. In this framework utility is posited to be a function of the plan characteristics (both observed and unobserved to the researcher) and the plan premium. Unlike most previous attempts to estimate differentiated product demand systems using market-level data that we are aware of, we allow for the observed characteristics of the plan to be correlated with the unobserved plan characteristics.

Our estimates indicate that the Medicare HMO program added approximately $1.5 billion in consumer surplus and $4.5 billion in HMO profits during the 1993 to 1999 period.[2] In 1999, the average Medicare enrollee earned $11.69 in consumer surplus because the Medicare+Choice program was available. To determine social surplus of Medicare+Choice, we must compare the benefits of the program to its costs. We estimate that the program increased welfare if the cost of enrolling the typical Medicare HMO enrollee in the Medicare FFS program is not less than 96% of the average payment made to Medicare HMOs. It is likely that Medicare HMO enrollees cost less than 96% of the average Medicare FFS enrollee. Thus, it is likely that the M+C program, as currently constituted, results in a societal net welfare loss.

Under TEFRA the payments made to HMOs varies across counties. The rules (and changes in these rules) under which the payments are determined generate a large amount of variation both across and within counties over time. Importantly, our county-level welfare measures embody the complex market outcomes of entry/entry and benefit/price competition. Thus, by regressing county average welfare directly on county size and the HMO reimbursement rates in a fixed effects framework, we are able to identify the effects of changes in the reimbursement rate on consumer surplus.

One of the important levers available to policy-makers is the HCFA payment rate. Recently, the issue of the optimal payment rate has become especially germane, as many HMOs have exited from the Medicare program affecting five percent of Medicare beneficiaries enrolled in HMOs (Gold and Justh 2000). The HMOs have justified their departure from the HMO market by claiming that the HCFA payments are too low for them to profitably operate.

We estimate the sensitivity of Medicare beneficiary consumer surplus and HMO profits to changes in the CMS payment rate. We find that an increase of $1.00 in the expected government outlay increases average Medicare beneficiary consumer surplus by $0.03. We estimate that HMO profits will increase by approximately $0.76. That is, both consumer surplus and profits increase with the increase in the payment level, however the HMOs are able to capture the vast majority of the increase. Importantly, the increase in consumer surplus and profits is less than the increase in the expected government expenditures implying that an increase in the payment level decreases total welfare.

We explore the reasons behind the small response of consumer surplus to changes in the CMS payment rate by simulation. We implement this simulation by first estimating reduced form equations for the number of plans in a market, the likelihood of a plan to provide drug benefits, the level of non-drug plan quality, and the plan premium as a function of the CMS payment rate and other control variables. These reduced form equations allow us to estimate the change in plan and market characteristics as a function of the payment rate.

Most of the increase in consumer surplus associated with an increase in CMS payment is attributable to plan entry. Thus, the small response in consumer surplus to changes in the payment level is the insensitivity of new plan entry to changes in the payment rate. The simulation results also reveal insights into the relationship between market structure consumer surplus and welfare. Once the change in market characteristics is estimated, it is straightforward to simulate their impact on consumer surplus and profits. We estimate that total welfare loss associated with the

[2] Figures are in 1998 dollars.

increase in payment is increasing in the number of plans operating in a county. The ratio of the increase of Medicare beneficiary surplus to HMO profits decreases in the number of plans operating in a county. Finally, the ratio of the increase in consumer plus producer surplus divided by the increase in government expenditures associated with increasing the payment rate is decreasing in the number of plans operating in a county.

Not only our results relevant for the current Medicare system, but they are also are germane for evaluating proposed Medicare reforms. Some Medicare reform proposals would shift the current emphasis from the current fee-for-service system to a form of managed competition (e.g. Dowd, Feldman and Christianson 1996). The efficacy of these reforms will largely depend on their ability to generate meaningful competition between HMOs. This, in turn, will depend upon the price sensitivity of Medicare enrollees and the willingness of HMOs to offer quality products. Our analysis directly bears on this question. We find that managed competition can generate significant consumer surplus for the elderly population. As a by-product of the welfare calculation, we can estimate Medicare enrollees' elasticity of demand for HMOs. We estimate that elasticity to be –3.34 for a typical HMO charging a positive premium. This finding is good news for the proponents of managed competition in the Medicare system. However, this news should be tempered by the finding that Medicare beneficiary welfare is relatively insensitive to changes in the CMS reimbursement rate. Thus, our work indicates that it may be very difficult to generate significant HMO competition in many counties.

The rest of the paper has the following structure. In the next section we discuss the Medicare HMO program. Section 3 sets out our empirical framework, while Section 4 discusses the data. Section 5 presents the results. Section 6 concludes.

2. Medicare HMOs

Medicare permitted HMO participation beginning in 1972. The Medicare program's interest in HMOs as an alternative method for delivering care grew during the 1970s, and they began experimenting with HMOs as demonstration projects in the late 1970s and early 1980s. By 1980, however, HMOs had virtually no role in the Medicare program as only one managed care organization had signed a risk contract (Group Health Cooperative of Puget Sound).

In 1982, with the passage of the Tax Equity and Fiscal Responsibility Act (TEFRA), Congress mandated the provision of managed care plan options to Medicare beneficiaries. The statute allows Medicare beneficiaries to enroll in risk or cost contract Health Maintenance Organizations (HMOs). Plans wishing to offer a Medicare risk product sign annual contracts with Medicare's administrative agency, CMS, to provide benefits to beneficiaries that voluntarily enroll with the HMO. In exchange for their participation, the plans receive a capitated payment for each enrollee they sign up. From 1982 until 1997, Medicare paid HMOs 95 percent of its projected cost (Part A + Part B) to treat a similar enrollee in the FFS program where similar was defined using age, gender, welfare status, institutional status, and location. This is referred to as the average adjusted per capita cost (AAPCC). Under this scheme, geographic units are counties, thus the CMS payment (the AAPCC) varies by county and over time.

In Table 1 we present the quartiles of the AAPCC in 1993 and 1998 (along with other summary statistics which we discuss later). The spread of the AAPCC in both years is rather large – 25% of the 1993 median and 20% of the 1998 median. The determination of the AAPCC (until 1998) was based on a five year moving average of Medicare's realized cost with the moving average window starting three years prior to the current year. Thus, the payment rate in period t is calculated using Medicare's realized costs in years t-3 to t-8. Not only does the AAPCC vary by county, there is significant variation over time within a county. The Medicare FFS payments to providers do not vary much by locale (although geography does enter in some of these calculations), thus most of the variation in the AAPCC is likely due to differences in the upper tail of the Medicare FFS risk profiles in a given county.

For those Medicare beneficiaries in counties where the Medicare HMO option is available, the choice for them is to either enroll in an HMO or remain in the FFS sector. In the FFS sector the enrollee is automatically enrolled into Part A of the program which covers hospital stays (with a small deductible) and catastrophic care. In addition, they can (and most Medicare eligible individuals do) enroll in Part B for a premium (in 1995 it was $42.50 per month). Part B covers physician services with a 20% coinsurance; lab and diagnostic tests; outpatient services with a 20% co-payment; and mental health care with a 50% co-payment. The deductible for Part B is $100 per year. Not covered in Medicare's Part A and B program is long-term care, prescription drugs, preventive care, dental care, and eye care. Most Medicare FFS enrollees also purchase Medigap insurance coverage that supplements Medicare Parts A and B by offer additional benefits. In 1998, 30 million Medicare enrollees, out of a total population of 38 million, purchased Medigap coverage (Bell 1999).

CMS requires HMOs to provide a minimum set of benefits—essentially equal to benefits offered under Parts A and B of the FFS Medicare program. In addition, the HMO can negotiate with CMS to provide additional benefits including (but not limited to) prescription drugs, eyeglasses, dental coverage, and preventative care. In addition, the HMO can charge a non-zero premium to their enrollees subject to CMS approval. Presumably, in each year HMOs observe the announced AAPCC in each county and evaluate whether to provide service in the county. Conditional on operating in a county, the HMO then decides the set of benefits to offer and premium to charge given Medicare beneficiaries preferences for the HMO, the competitive environment and the expect cost to providing care.

Until the mid-1990s HMO participation in the Medicare program was anemic. In 1993, eleven years after the passage of the TERFA, only 4% of Medicare beneficiaries were enrolled in an HMO and in only 20% of the counties did a HMO offer a Medicare product. From 1993 until the 1997 there was a substantial increase in the number of HMOs operating and a simultaneous increase in the number of Medicare beneficiaries enrolling in HMOs. Figure 1 graphs the average number of HMOs per county. In 1993 there were 0.37 HMOs per county and that number increased each year until 1998 when there were 1.26 HMOs per county. A large number of HMOs exited the Medicare market in 1999 reducing the average number of HMOs per county to 0.86.

The decline in the number of HMOs corresponds to changes in the methodology for determining the CMS payment to HMOs enacted under the Balanced Budget Act (BBA) of 1997.

The BBA modified Medicare's payment methodology in two basic ways.[3] First, it changed the method used to calculate county HMO rates. Second, the BBA modified the method by which individual payment rates are derived from county HMO rates, as it required CMS to adjust payments based on the diagnoses from hospital claims. The county rates in 1998 and thereafter are based on the 1997 county rate book and not on the experience of fee-for-services enrollees in each county in the previous year. The county rates are set equal to the maximum of three rates: blended input price adjusted national rate and an area-specific rate; a floor payment designed to increase the rates in low paying counties; and minimum rate increases of 2% per year. While the determination of the new rates is based on a rather complex formula, the important feature for this paper is that the net effect is a substantial decrease over what the HMOs would have received prior to the BBA in most counties. CMS researchers estimate that the BBA methodology lowers the payments to HMOs by an average of 7 percent (HCFA 1999). In addition to reducing the level of payments, the BBA appears to have diminished the variance of the payments across the counties. According to Table 1, the 1993 the inter-quartile range divided by the median is 0.25. In 1998, the corresponding figure is 0.20. In addition to changing the payment rates, the BBA also removed the restriction that at least 25% of a HMOs enrollees must be drawn from non-Medicare population.

Much of the research studying the HMO Medicare program has focused on risk selection and seeks to ascertain whether Medicare HMO enrollees have different cost characteristics than the general Medicare population. This literature generally, but not unanimously, concludes that HMOs receive a lower cost pool of enrollees than the general Medicare population, however the estimated magnitude of the cost differential varies widely (Hillenger and Wong 2000). These findings suggest that the HMOs are, as a matter of public policy, overpaid. It was this belief that, in part, was the foundation to the desire to lower HMO payments in the BBA.

While understanding the cost of treating the HMO population in the FFS system is important for calculating the optimal CMS payment level, it is only one component of the proper welfare calculation. Medicare HMOs are a different product than the FFS system as they offer different

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[3] With the passage of the BBA, the Medicare HMO program also received a new name: "Medicare+Choice."

benefits and a different approach to care than the FFS system. Medicare beneficiaries have begun to enroll in HMOs in substantial numbers suggesting that those beneficiaries receive welfare above what they would get in the FFS sector. In the next section we outline our methodology for estimating the magnitude of this benefit.

3. The Empirical Framework

A. Estimating Consumer Surplus

The first step in estimating consumer welfare is to specify and estimate the parameters of a utility function. We note that HMOs are differentiated products as within counties different HMOs offer different benefits and charge differential premiums. Our approach is similar to that of Trajtenberg (1989), Berry and Waldfogel (2000), Berry, Levinsohn, and Pakes (1998), Petrin (1999), Rysman (2000) and Goolsbee and Petrin (2001) in which we estimate the parameters of a utility function in a discrete choice model of consumer behavior in a differentiated products framework. We then use these parameter estimates to formulate measures of welfare.[4]

Our data are aggregated to the plan/county level. Berry (1994) shows with aggregated, market-level data, it is possible to derive a simple, linear regression equation that corresponds to a Nested Logit, discrete choice model of individual consumer demand. In our specification there are three nests: enrolling in a HMO offering prescription drug coverage, enrolling in an HMO that does not offer prescription drug coverage or remaining in the standard fee-for-service Medicare program. Our specification allows for Medicare enrollees to have differing views over the desirability of managed care plans.

Specifically, we begin by assuming that utility is given by:

$$u_{ijt} = \xi_{jm} + d_{jmt}\beta - \alpha_1 p_{jmt} + \zeta_{iDrug}(\sigma) + e_{jmt} + (1-\sigma)v_{ijmt}\,. \qquad (1)$$

Here u_{ij} is the indirect utility of Medicare beneficiary *i* who lives in county *m* of enrolling in plan *j*, d_{jm} is a dummy variable indicating whether perscription drug benefits are offered by plan *j* in county *m*, p_{jm} is the premium charged, ξ_{jm} is the unobserved, time invariant component of plan

[4] Hausman (1997) proposes a different approach to estimating welfare in a differentiated products framework.

desirability and e_{ij} is the shock to plan desirability. Each individual is assumed to have differing preferences over HMO offering drug benefits and HMO products that do not offer a drug benefit. Those differences across individuals are not observable to the researcher. Differences across individuals in their preferences for drug coverage are captured by $\zeta_{iDrug}(\sigma)$ which has a distribution that depends on σ. The individual error term, v_{ijmt} is distributed iid, Type I Extreme Value.

The outside good is defined as remaining in the Medicare FFS program and signing up for supplemental Medigap coverage. The majority of Medicare FFS enrollees also supplement their coverage with a Medigap policy. We have obtained premium information on Medigap coverage from the American Association of Retired Persons (AARP), thus we have information of the price of the outside good. We normalize the unobserved quality of the Medicare, FFS program with Medigap coverage to zero. The utility of the outside good is then $u_{i0t} = -\alpha_0 p_{0mt} + \upsilon_{i0}$, where p_{0mt} is the Medigap premium.

Ackerberg and Rysman (2001) and Bajari and Benkard (2001) note that the formulation in (1) has some potentially unattractive features.[5] The model places restrictive assumptions on the error structure that can lead to adverse effects on estimated elasticities and welfare calculations. In particular, Ackerberg and Rysman note that following three comparative statics are captured by only two parameters: $\frac{\partial s_{Drug}}{\partial p_j}, \frac{\partial s_{Drug}}{\partial J}$ and $\frac{\partial s_{Drug}}{\partial p_j}$ where s_{Drug} is the within nest share and J is the number of HMOs in the market. The implication is that the model places tight functional form restrictions between the value to enrollees of additional plans and the various elasticities. Ackerberg and Rysman (2000) suggest modifications to Berry (1994) framework that allows the comparative statics listed above to be determined by the data and not by functional form. One correction they suggest, and it is the one we adopt here, is including a function of the number of firms operating in the market as an argument in the utility function.

The parameters in (1) can be estimated using the following linear, share equation,

$$\ln(s_{jmt}) - \ln(s_{0mt}) = \xi_{jm} + d_{jmt}\beta - \alpha_1 p_{jmt} + \alpha_2 p_{0mt} + \sigma \ln(s_{j|Drug}) + f(J) + e_{jmt}, \qquad (2)$$

where s_{jm} is the share of enrollees (relative to the entire potential purchasers, not just those beneficiaries who select an HMO) who enroll in plan j in county m, $s_{j|HMO}$ is the within HMO drug category market share and s_{0m} is the share of consumers who purchase the "outside good." Again, we are following the advice of Ackerberg and Rysman and are including the term $f(J)$ to the utility function which accounts for its inclusion in (2). We parameterize $f(J)$ as $\alpha_3 \ln(J)$.

Given the above assumptions the HMOs market share, the within drug category market share, and the overall HMO penetration rate is given by:

$$s_j = s_{j|Drug} s_{Drug}\ ;\ s_{j|Drug} = \frac{e^{\frac{\xi_j - \alpha_1 p_j + x_k\beta + \alpha_3 \ln(J) + e_{jm}}{1-\sigma}}}{D_{Drug}}\ ;\ s_{Drug} = \frac{D_{Drug}^{1-\sigma}}{\sum_{Drug=0,1} D_{Drug}^{1-\sigma} + e^{-\alpha_0 p_0}}$$

$$\text{where} \qquad s_{HMO} = s_{Drug=1} + s_{Drug=0} \qquad D_{Drug} = \sum_{k=1}^{J_{Drug}} e^{\frac{\xi_k - \alpha_1 p_k + x_k\beta + \alpha_3 \ln(J) + e_{km}}{1-\sigma}}.$$

In our specification we use only an indicator of whether the plan offers drug benefits in the list of observable plan characteristics. The current Congressional debate over the extension of Medicare FFS to include some form of drug coverage strongly suggests that prescription drug benefits are likely to be the most important benefit that Medicare HMOs can offer. We experimented with including other plan characteristics such as eye care benefits, however these variables generated coefficients that were not sensible and were imprecisely estimated.

In order to estimate the parameters in (2) we need to specify both the total size of the market and the nature of the outside good. In our specification, there are two types of products: Medicare HMOs and Medicare FFS with supplemental Medigap coverage. This is a simplification of the actual chooses that Medicare eligibles can make. Approximately 10% of the Medicare population is also eligible for Medicaid benefits. Medicaid benefits are generally more generous than benefits available through the Medicare program. We assume that those Medicare beneficiaries that are eligible for Medicaid benefits will enroll in the Medicaid program and will not consider

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[5] Also see Petrin (2000).

enrolling in an HMO or obtain Medigap coverage. We use state-level Medicaid enrollment information to adjust the size of the market. That is, $s_j = \frac{q_{jct}}{M_{ct}(1-mcaid_{ct})}$, where q is the number of enrollees, M is the number of Medicare eligibles, and *mcaid* is the statewide Medicaid enrollment rate for Medicare eligibles.[6]

Also, many Medicare enrollees receive subsidized insurance through their former employer and this subsidy can be used to purchase either supplemental insurance or to enroll in an HMO. We are unaware of any publicly available, county level information on the number of Medicare enrollees who receive this benefit, thus we cannot control for this possibility in the estimation. However, we do not view this omission has seriously biasing our results. The employer decision on whether to offer an HMO in the menu of retiree benefits will likely depend on the premium charged by the HMO. That is, employers are likely to have some price sensitivity, and, in so far as retiree benefits impact HMO choice, we wish our parameters to reflect that. Second, many retiree benefit packages do not cover the full cost of supplemental insurance. Thus, marginal price differences are likely to be paid by the enrollee, thus making their marginal decisions similar to those who do not have as generous retiree benefits.

Several features of the data make it well suited for the Berry framework. First, we have multiple observations on many different markets (over 3,000 counties are in our data) and these markets experience significant entry and exit. Importantly, the geographic scope of each market is well defined. A discussed in the previous section, the Medicare rules specify that each county is a separate entity for the purposes of premium setting and benefit design. Thus, we have market-level as well as HMO-level variation in the data.

A well-known problem associated with estimating equation (2) is that the HMO-specific error term, $\xi_{jm} + e_{jmt}$, is likely to be correlated with price, implying that OLS estimates of (2) will generate biased price coefficients. Most previous attempts to estimate parameters from a differentiated products model assume that the characteristics of the product are independent of the

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[6] Our parameter estimates are largely insensitive to adjustments in the size of the market.

firm-specific error term. If true, Berry (1994) and Berry, Levinsohn, and Pakes (1995) suggest using functions of characteristics of competitors as instruments for price in an instrumental variables framework. However, the same logic that suggests that estimates OLS estimates of the price coefficient are biased may also apply to the parameters on the product characteristics. If HMOs optimally select plan characteristics, the benefit structure will likely be correlated with the HMO-specific error term. In such circumstances, estimation of (2) in which the *d*'s are not treated as endogenous may also generate biased coefficient estimates of the β's. This issue is likely important in most empirical applications and it is particularly relevant in our case as it is relatively easy for HMOs to add or subtract benefits to their plan design.

Our estimation strategy is to use plan-level fixed effects to control for correlations between ξ_{jm} and the other right hand side variables. As the plan-specific shock, e_{jmt}, is also potentially correlated with the right hand side variables we will also need to employ an instrumental variable (IV) approach to control for the endogeneity of price and benefit structure (Baltagi and Chang, 2000).

We are able to formulate instruments for premium and the product characteristics thus we can treat all of these variables as endogenous. We construct instruments using two strategies. First, we use county-level variables that vary across time and likely have supply-side impact. Those variables include the size of the county (as well as the logarithms and polynomials of these values and interactions), the one-year lagged numbers of physicians, hospitals, and hospital beds. As we have plan-level fixed effects the identification of the parameters comes from within plan variation in the instruments. The Medicare enrollment in a county is a valid instrument because it is not an argument in the utility function and it is correlated with the number of competing plans and the characteristics of those plans. That is, counties where Medicare enrollment is expanding more rapidly are more likely to experience plan entry, and under very general conditions, the number of competing HMOs will be correlated with the premium and the benefit package. The lagged values of the number of physicians, number of hospitals and hospitals beds should be valid instruments as they impact the HMOs relative bargaining power and thus their cost structure.

It is tempting to use the CMS payment rate as an instrument as it is likely correlated with both the premium and the probability that the HMO will offer drug benefits. However, it is also likely that the HMO will increase other dimensions of plan quality in response to an increase in the CMS payment rate. That is, the error term in equation (2) is likely correlated with the payment rate making it an invalid instrument.

The second strategy in formulating instruments relies on the likelihood that the competitive characteristics of neighboring counties will impact a plan's benefit design. Ideally, our instrument set should have both county- and plan-level variation. To generate plan-level variation we add to the instrument set the CMS payments that competing plans receive in counties in which the HMO in question does not compete. In particular, for plan *j* operating in county *c*, we find all the competing plans that also operate other counties. We then identify the counties in which the competing plans operate and plan *j* is not present. The instruments are the average, the minimum, and the maximum CMS payment rate of the county nearest to county *c* divided by the square root of the distance to that plan. If the plan is a monopoly then these sets of instruments are set to zero. The logic behind this choice of instruments is that if there are economies in providing a benefit for a given plan across counties then the payment rates in others counties should affect the provision of that benefit for the competing plans in the county of interest.

Once the parameters of (1) are estimated it is straightforward to calculate the annual consumer surplus for each county. We denote the consumer surplus per Medicare beneficiary in a county *in* a given period by W_{mt}. As shown by McFadden (1983) the expected consumer surplus from the Medicare+Choice program for the representative person when utility is given by the specification in (1) is

$$W_{mt} = \frac{1}{\alpha_1}\left((1-\sigma)\ln\left(e^{\frac{-\alpha_0 p_{0mt}}{1-\sigma}} + \sum_{j\in D_{mt}} e^{\frac{\xi_j + e_{jmt} + d_{jmt}\beta - \alpha_1 p_{jmt} + \alpha_3 \ln(J)}{1-\sigma}} + \sum_{j\in ND_{mt}} e^{\frac{\xi_j + e_{jmt} - \alpha_1 p_{jmt} + \alpha_3 \ln(J)}{1-\sigma}}\right)\right) \quad (3)$$

where m indexes the county, D_{mt} is the set of HMOs offer prescription drug benefits in county m at time t and ND_{mt} is the set of HMOs that do not offer prescription drug benefits in county m at time t. The welfare calculation in (3) measures the utility an individual receives above their expected utility from remaining in the Medicare FFS system. The normalized expected welfare that an individual receives from having access only to the FFS system is: $\frac{1}{\alpha_1}(1-\sigma)\ln\left(e^{\frac{-\alpha_0 p_{0mt}}{1-\sigma}}\right)$

Once we calculate county-level welfare it is straightforward to aggregate that welfare to national levels.

B. Estimating HMO Profits

Total welfare is the sum of consumer and producer surplus. To fully account for the welfare impact of Medicare+Choice program it is necessary to estimate the profits that accrued to HMOs from their participation in the program. Estimating HMO profits is not straightforward as the appropriate measures of costs are unavailable.[7] In general, given the plan's demand function, it is possible to form estimates of marginal costs by assuming static, profit-maximizing behavior and inverting the plans' price setting first-order condition. In the Medicare+Choice program many plans charge zero premiums thus they are at a corner solution and therefore we cannot invert the first-order conditions to get an estimate of the marginal cost. However, if we make some assumptions about the structure of marginal costs for those plans that charge a zero premium, we can place a lower bound on their profits.

For the profit calculation we assume that the marginal cost of insuring an individual is constant in the number and composition of enrollees.[8] The profits in county *m* for plan *j* can be written as:

$$\pi_{jm} = \left(a_m + p_{jm} - c_{jm}\right)s_{jm}M_m - F_m \tag{4}$$

Here a_m is the AAPCC payment rate to the HMOs, c_{jm} is the marginal cost of an enrollee, M_m is the number of Medicare eligibles not enrolled in Medicaid in the county, F_m is the fixed cost and the rest of the notation is the same as before. Assuming the plan sets the premium to maximize static profits and the optimal premium is greater than or equal to zero, the first-order condition is,

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[7] Accounting reports are available on Medicare HMOs. Using accounting profits to measure economic profits has long been viewed as problematic, and these problems are particularly acute with HMO accounting data.

[8] This assumption implies there is no adverse selection in this market. Obviously, this is a questionable assumption here. However, allowing for adverse selection substantially increases the difficulty of this problem. In future work, we plan to address the issue of adverse selection in an oligopoly equilibrium more completely.

$$s_{jm} + (a_m + p_{jm} - c_{jm})\frac{ds_{jm}}{dp_{jm}} = 0. \tag{5}$$

The Nested Logit assumption implies that $\frac{ds_{jm}}{dp_{jm}} = \frac{-\alpha_1}{1-\sigma} s_{jm}(1-\sigma s_{j|Drug} - (1-\sigma)s_{jm})$. Subject to the two adjustments discussed below we will assume that (5) holds with equality for those plans charging a zero premium. Solving (5) for marginal cost gives our estimate of a plan's marginal cost as a function of the data and estimated parameters,

$$\hat{c}_{jm} = a_m + p_{jm} + \left(\frac{ds_{jm}}{dp_{jm}}\right)^{-1} s_{jm}. \tag{6}$$

To calculate the profits, we use (6) to form estimates of the marginal cost, $\hat{c}_{jm}$, and substitute the estimated marginal cost in for c_{jm} in equation (4). In the implementation make two adjustments to the calculation of (6) to improve the accuracy of the estimate. First, if a plan changes a positive premium in some period and then later charges a zero premium we take the estimate of $\hat{c}_{jm}$ to be for those years in which the premium is zero to be the $\hat{c}_{jm}$ for the year in which the plan was charging a positive premium. We adjust this marginal cost measure for time and changes in the benefit package. Similarly, if a plan only charges a zero premium for the years it offers a Medicare product, we take the current measure of $\hat{c}_{jm}$ to be the lowest marginal cost across the years, again adjusted for time and the benefit package. We make these adjustments because using (6) to calculate marginal cost implies that an increase in the payment rate is inferred to be associated with a one-for-one increase in marginal cost. Clearly, that is an unattractive assumption that we wish to avoid.

Because of the assumptions we impose, our estimate of HMO profitability comes with at least two important caveats. First, we likely overestimate marginal cost for those plans that set their premium to zero for all periods. Second, without imposing additional assumptions, we cannot formulate an estimate of the fixed cost of operating a Medicare+Choice plan in the county.[9] Thus our measure of profits is simply variable profits. Because of these caveats we view our profits measures as a rough estimate of true HMO profits. Importantly, because we do not have a measure of fixed costs, we will not be able to identify any inefficiencies due to excess HMO entry.[10]

C. Consumer Surplus, Profits and the CMS Payment Rate

Once we have formulated the county-level panel of consumer surplus, we are interested in understanding how that welfare is affected by changes in the CMS payment rate. Changes in the payment rate may affect Medicare beneficiary welfare via several different mechanisms. Increases in the payment rate may increase the incentive for HMOs to enter which, in turn, increase the degree of competition among HMOs for Medicare enrollees. This increased competition can yield more generous benefits, lower premiums and increased product diversity. In addition, holding the number of HMOs in a market constant, increases in the payment should put downward pressure on premiums paid by enrollees and upward pressure on the benefit design. The benefit consumers get from increases in the payment rate will depend on the elasticity of HMO entry to changes in the payment rate, the sensitivity of premiums and benefits to increases in competition, and the sensitivity of premiums and benefits to changes in the payment rate.

We observe a large amount of variation both across and within counties in CMS payments. The within county standard deviation in the CMS payment rate, controlling for annual changes in the payment level, accounts for 21% of the total standard deviation in the payment rate. In addition, as discussed previously, there were several rule changes in the determination of the payment structure over the sample period generating even more variation. Thus, by regressing county average welfare on market size measured by the number of Medicare beneficiaries and the

[9] For example, if we assume that the fixed cost are the same across firms, then, in a static framework, the optimal entry condition implies that the fixed cost must be less than the smallest observed variable profits. In our data the smallest estimated variable profit is approximately $300. That strikes us as too small to be plausible.
[10] See Berry and Waldfogel (1999) for evidence of excess entry into radio broadcasting.

HMO reimbursement rates in a fixed effects framework, we are able to identify the effects of changes in the reimbursement rate on consumer surplus.

Most counties lack a Medicare HMO. This implies that our measure of consumer surplus is censored at zero, as Medicare beneficiaries cannot receive consumer surplus unless they are able to enroll in an HMO. Also, there are county level variables that we do not directly observe that would likely affect the number and quality of the HMOs that operate in a market. Collecting the appropriate data is problematic as either it does not exist or is not at the appropriate level of aggregation. We correct for the lack of appropriate county level information by using a fixed effects framework. Specifically, we estimate the following relationship:

$$W_{mt}^{*} = \mu_m + \lambda_t + \delta_{1t} Payment_{mt} + \delta_2 Beneficaries_{mt} + \delta_3 W_{mt-1} + e_{mt} \qquad (6)$$

where W^{*} is a latent variable and is not observable to the researcher. However, we do observe W_{mt}, the per capita consumer surplus, where $W_{mt} = W_{mt}^{*}$ if $W_{mt}^{*} > 0$ and $W_{mt} = 0$ otherwise. This is the standard censored dependent variable (Tobit) problem with the added complications that we wish to include county fixed effects and lagged dependent variables. The lagged dependent variable is included to account for potential stickiness in market structure and plan benefits. We estimate the parameters from (5) using a GMM methodology as suggested by Honore′ (1993). This approach has a couple of advantages over the more traditional dummy variable, fixed effects, Tobit methodology. First, we do not have to make distributional assumptions on the error term other than they are i.i.d. Second, as we have many fixed effects (one for each county—3,208) it is impractical to include county dummy variables in the regression. In Honore′s procedure the fixed effects are differenced out and therefore are not directly estimated making a fixed effects approach feasible with our data. A potential disadvantage of this approach is that in differencing the data there can be a large loss of information.[11]

We are interested in estimating the contemporaneous impact of changes in the payment rates and size of the Medicare population on average consumer surplus. The δ's form a summary of the complex competitive interactions of HMO entry, exit, benefit design, product quality, and

[11]A disadvantaged of the Honore' approach is that we cannot include year dummy variables.

premium setting which are presumably affected by changes in the CMS payment rate and changes in the size of the potential market. We allow the CMS payment rate δ's to vary linearly over time. The effect of the changes in the CMS payment rate may vary as expectations about the future path of the payment rate adapt, the average county market structure evolves, and the cost structure changes.

To get a better sense of where welfare is generated, we decompose the relationship between welfare and the number of HMOs, the benefit structures of the plans, and the CMS payments. We do this via simulation. Changes in the payment rate may affect Medicare beneficiary welfare via several different and interrelated mechanisms. Increases in the payment rate may increase the incentive for HMOs to entry that, in turn, increases the degree of competition among HMOs. This increased competition can yield more generous benefits, lower premiums and increased product diversity. In addition, increases in the payment rate should put direct downward pressure on premiums and upward pressure on plan quality.

There are two potential strategies for estimating the plan response to changes in CMS payment levels: structural and reduced form. A structural strategy would likely require estimating a dynamic model of Medicare HMO entry, exit, benefit design, and premium setting. While such models have been estimated in simpler frameworks (Gowrisankaran and Town 1997), estimating this model on our data is a difficult problem, which we save for future research.[12] Instead, we rely on estimating the market and plan responses to changes in the CMS payment level using a reduced form approach.

We estimate the parameters of several different, reduced form, fixed effects regressions. We estimate the relationship between the number of plans operating in a county and payment rate, the number of Medicare eligibles, number of hospitals in the county, year dummies and the lagged number of plans operating in the county. The count data relationships are estimated using a Negative Binomial, GMM methodology. Once we estimate these parameters we then take a draw from that probability distribution to determine whether a given county experiences an entry.

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[12] Also see Benkard (2000).

We also estimate the relationship between the plan characteristics, premium, drug benefits, and unobserved quality, and market and plan level characteristics, summarized by the system of equations below:

$$p^*_{jt} = \theta_{01} + \theta_1 x_{1jt} + \psi_{jt} \qquad (7a)$$
$$d^*_{jt} = \theta_{02} + \theta_2 x_{2jt} + \gamma_2 d_{jt-1} + \upsilon_{jt} \qquad (7b).$$
$$\hat{\xi}_{jt} = \theta_{03} + \theta_3 x_{3jt} + \gamma_3 \hat{\xi}_{jt-1} + \nu_{jt} \qquad (7c)$$

Here x_{jt} is set of market and plan level variables including the CMS payment level, the number of plans operating in a county, the number of plans offering drug benefits, plan characteristics and interactions between several of these variables.[13] The first two dependent variables are $p_{jt} = p^*_{jt}$ if $p^*_{jt} > 0$ and $p_{jt} = 0$ otherwise; and $d_{jt} = 1$ if $d^*_{jt} > 0$ and $d_{jt} = 0$ otherwise. We estimate (7a) and (7b) using a Tobit and Logit procedure that allows for the error terms to be correlated with the independent variables and lets us uncover $\theta_{01} + \psi_{jt}$ and $\theta_{02} + \upsilon_{jt}$ for each observation as suggested by Chamberlain (1982, 1984). The parameters from (7c) are estimated using the fixed effects, GMM methodology as suggested by Arellano and Bond (1991).

In the simulations we assume that plans make decisions sequentially over their characteristics. When faced with an increase in the payment level we estimate the probability distribution that incumbent plans will offer drug benefits—we then draw a randomly draw a realization from that distribution. Conditional on their drug offering decision, we then estimate the new level of $\hat{\xi}$, and then finally given their decisions on the drug offering and $\hat{\xi}$, we estimate their expected premium. Once changes in the number of plans and plan characteristics have been estimated, it is straightforward to calculate the change in consumer surplus using equation (3). In order to calculate the change in profits associated with the change in payments we must account for the change in costs associated with a change in plan benefits. We do this by regressing the estimated marginal cost on plan characteristics and use the resulting coefficients to calculate an increase in the marginal cost associated with the change in plan characteristics. Our estimates indicate that the addition of drug coverage increases the plans marginal cost \$51 per month and a one unit increase in ξ increases plan costs by \$8.0.[14]

In order to estimate the characteristics of newly entered plans we estimate (7a-c) for newly entered plans without lagged dependent variables. The parameter estimates imply probability distributions for drug benefits, $\hat{\xi}$, and the premium. We then take draw a random realization from these probability distribution to determine the plan's characteristics. To calculate the newly entered plans profits we assume that prior to the increase in the payment rate the plan was indifferent to entering the market. Given that assumption, calculating the profits of the entrant is straightforward.

4. Data

Data in this study come from three sources: CMS, AARP and the Area Resource File. From CMS, we merge four files on Medicare HMOs to create a HMO/county level panel data set. The four CMS files are: 1) the State-County-Plan Penetration file; 2) the Medicare+Choice /AAPCC Standardized Per Capita Rates of Payment; 3) Medicare Metropolitan Statistical Area Code File; 4) the Monthly Report — Medicare Coordinated Care Health Plans and 5) Annual State Medicaid enrollments.

For plans offering a Medicare HMO risk contract in a county we assemble information on the plan's share (quantity enrolled in the HMO divided by the total number of Medicare beneficiaries in the county), the premium charged, indicators of whether the plan offered drug, eyeglass and dental coverage. In addition, for each county in each year we merge in the CMS payment rate (Part A + Part B). We deflate the HMO premium and the CMS payment by the CPI.

In the CMS penetration files, HMO enrollees are assigned to counties by county of residence not according to whether the HMO is operating in the county. This implies that for many counties there is an unrealistically high number of HMO with very little enrollment (less than 10 enrollees). For our purposes, a HMO is defined as participating in a county, and is therefore

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[13] In addition to the market and plan level characteristics, we also include the instruments for estimating the utility parameters to the list of *x* variables.

included in the data set, if the plan has enrolled at least 0.5% of the counties enrollees or has it has an enrollment greater than 25 members.[15] This definition of county enrollments is similar to the one used by Crawley, Chernew and McLaughlin (2001).

From the AARP we acquired annual premiums for their Medigap policy Plan F to proxy for the price of the outside good.[16] Plan F covers Part A and B deductibles, skilled nursing, and physician bills above the Medicare payments. The AARP sets annual premiums on a statewide basis with the exception of California and Florida where the premiums are set county by county. AARP's Medicare supplemental insurance has approximately 2 million enrollees and is one of the largest Medigap plans in the county. As there are few restrictions on who may enroll in the plan and it is offered nation-wide, this data is a good proxy for the price of Medigap insurance. From the Area Resource File, we merge in data on the number of physicians, hospitals, and hospital beds. These variables are used as instruments in estimating the utility parameters.

Table 1 presents summary statistics for 1993 and 1999, the beginning and end of our data. As discussed earlier, in Table 1 shows the large increase in HMO participation in the Medicare program over the period. Over our sample period, the likelihood that a county had a Medicare HMO increased from 20% to 31%, and the average number of HMOs operating in a county increase from 0.37 to 0.87. The average size of a plans enrollment within a county increase over this period from 1,525 to 2,272. However, the number of benefits offered increased substantially while the average premium declined markedly. The percentage of plans offering drug benefits increased from 44.6% to 72.3%. Over this period the average premium declined from $32.64 to $8.09 and the percentage of plans offering a zero premium increased from 36.1% to 78.8%

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[14] HMO executives have confirmed that our estimates of the marginal cost of drug coverage for Medicare eligibles is reasonably accurate.

[15] We discussed this definition with HCFA staff to insure its reasonableness.

[16] AARP offers several different plans. We estimated the parameters using premiums from the other AARP plans and found that the parameter estimates were not quantitatively different from those presented here.

5. Results

A. Parameters Estimates of the Utility Function

Table 2 presents the estimates of the utility parameters, equation (1) using different estimation methodologies and model specifications. The first column of Table 2 presents the results from our preferred specification—the Ackerberg-Rysman Nested Logit with the HMO benefits treated as endogenous. The coefficient on HMO premium is –0.042 and precisely estimated (t-statistic = -2.78). The coefficient on the presence of drug is 3.99 and precisely estimated (t-statistic = 3.53). The parameter on the Medigap premium is positive (as expected) and is also reasonably precisely estimated (t-statistic =2.89).

The parameter on the logarithm of within category market share which measures the within nest correlation in errors, σ, is 0.63 with a t-statistic of 2.86. The implication is that there is significant individual heterogeneity in their preferences over HMOs. The coefficient on the logarithm of number of plans in the market is –0.66. The implication is that utility that beneficiaries receive from product variety is less than those implied by the simple Nested Logit framework. The coefficient estimate is not precisely estimated, t-statistic = -1.20, suggesting that the evidence in favor of our preferred specification is not overwhelming.

In column (2) we present the results from an alternate, simple Logit specification. The coefficients estimates are similar to those presented in column (1). In column (3) we estimate a simple Logit version of the specification in column (1) without the logarithm of the number of firms included as regressors. For comparison purposes, column (5) presents the OLS results.

Column (4) of Table 2 presents the IV estimates when the prescription drug benefits are treated as exogenous. The coefficients on the drug benefits are very different from column (1). The coefficients are small in magnitude and the coefficient on drug benefits, generally viewed as a very desirable benefit, is implausibly negative. The difference in the benefits coefficients across the two specifications suggests that the benefit structure is correlated with the HMO specific error term and hence is endogenous. Failure to correct for the endogenous benefit structure will yield biased estimates. The simple correlation between the estimated ξ_{jm} from the column (1) coefficients and whether a plan has a prescription drug benefit is –0.75. HMOs that are of unobservabley poor quality are more likely to offer a drug benefit. Or, the causality maybe reversed: when HMOs decided to provide drug benefits they reduce other benefits.

The Nested Logit framework implies a simple closed form relationship for the HMO's own-price elasticity. This elasticity is given by $\gamma_{mj} = \frac{\alpha_1}{1-\sigma}(1-\sigma s_{j|Drug} - (1-\sigma)s_{jm})\,p_{jm}$ and is only defined when the HMO charges a non-zero premium. Conditional on the HMO charging a non-zero premium, the mean (unweighted) own price elasticity is –3.34 (median = -2.80, standard deviation 2.0). This suggests that there is nontrivial price sensitivity on the part of Medicare HMO enrollees. As the price elasticity is only defined for positive prices, a more meaningful measure of price sensitivity for our purposes is the semi-elasticity of an increase in the premium of \$5. The mean semi-elasticity is –0.36.

Not surprisingly, the estimated elasticity is somewhat less than elasticity estimated for younger enrollees. Using a different dataset, Town (2001) estimates that the elasticity of demand for 30-40 year olds is –5.1 and declines in magnitude with age so that for 50-54 year olds it is –4.1. The estimated decrease in the elasticity of HMO demand with age is consistent with anecdotal evidence and recent research that indicates that a reduction in health status decreases the price sensitivity of HMO enrollees (e.g. Schlesinger *et al.* 1999).

The cross-price elasticity of substitution between enrolling in an HMO and enrolling in Medigap insurance ($\frac{ds_{HMO}}{dp_0}\frac{p_0}{s_{HMO}}$). Conditional on a county having an HMO product, the average elasticity is estimated to be –1.79 (median = -1.78, standard deviation 0.34). McLaughlin, Chernew and Taylor (2001) use individual level data from the Community Tracking Survey to estimate the effect of Medigap pricing on the likelihood of HMO enrollment. They estimate that the elasticity to be approximately -2.05. These two estimates are not statistically different from each other. McLaughlin, Chernew and Taylor (2001) allow for observed individual heterogeneity to affect their elasticity estimates, thus the closeness of the two elasticity estimates provides some independent support for the proposition that Nested Logit formulation adequately accounts for the important dimensions of individual heterogeneity for the purpose of addressing the questions we are interested in.

B. The Welfare Impact of Medicare HMOs

With the parameter estimates from Table 2 in hand we are now able to calculate per capita (relative to the entire Medicare population) and total welfare by county. In Table 3 we present the mean monthly per capita consumer surplus and HMO penetration and percentage of plans offering drug benefits by the number of plans operating in the county for 1997. Several features displayed in Table 3 are worth mentioning. First, most counties do not have an HMO offering a Medicare product. Second, consumer welfare and the HMO penetration rate is, for the most part, steadily increasing in the number of plans offered in the county. Third, the benefits of the Medicare HMO program are not widely dispersed. In counties with one plan, the average monthly consumer surplus per Medicare beneficiary is $0.03 while in counties with 5 plans the average consumer surplus is $0.64.

Table 4 presents the estimated aggregate consumer surplus and profits by year. Over the 1990's there has been substantial growth in the benefits Medicare beneficiaries receive from having the HMO option. In 1993, we estimate that the total consumer surplus was $44.2 million. By 1999, consumer surplus had grown to $455.9 million. The total consumer benefit over the six-year period from 1993 to 1999 is $1.530 billion. According to our estimates, HMOs enjoyed a large share of the benefits of this government initiative. HMO profits in Medicare have been substantial albeit the relative profit margins are modest. In 1999, the total estimated HMO profits are $1.285 billion. That translates into a monthly average of $17.0 per Medicare HMO enrollee, and the profit margin relative to total revenue is approximately 3.2%. Over the entire sample period HMOs earned $4.500 billion in profits.[17]

[17] In Tables A1 and A2 we present the welfare calculations using the simple Nested Logit model estimates column 2, Table 4. The estimates from the simple Nested Logit yield 12% larger consumer and HMO welfare estimates.

Table 4 also presents the total CMS payments to HMOs over the corresponding period. The payments range from $10.9 billion in 1993 to over $39.7 billion in 1999. The net welfare from this government program will be given by:[18]

$$\textit{Net Welfare} = (CS_{HMO}\text{-}\textit{HCFA Payments}) - (CS_{FFS} \; - \; \textit{Expect Cost under FFS}) \; + \; \textit{HMO profits}\,.$$

Here *CS* denotes consumer surplus. We have normalized CS_{HMO} so that $CS_{FFS} = 0$. The HMO option will have generated positive societal welfare as long as the cost of treating those HMO enrollees under the FFS system is less than 95.8% the actual payments made to the HMOs. There are some who would argue that we should discount HMO profits in this welfare accounting. If we do so, the 95.8% figure increases to 98.9%. The administrative prices were originally set to be 95% of the expected cost to treating Medicare enrollees in a given county. As discussed in Section 2, many analysts believe that, largely due to risk selection, the Medicare HMO population would have been cheaper to treat in the FFS system than the typical Medicare beneficiary (Hilliger and Wong 2000). This belief has led many researchers and policy analysts to conclude that the Medicare system is (or at least used to) overpay HMOs. This belief is based on the view that HMOs should not earn profits via the Medicare system and that payment levels do not affect HMO behavior.[19]

There is some evidence on the expected cost of treating the Medicare HMO enrollees under the counterfactual that they remained in the FFS program. While most of the research indicates that Medicare HMOs receive favorable selection, the estimates of the magnitude of the difference vary substantially. Thus, it seems likely that the M+C program resulted in society welfare loss.

Riley *et al.* (1996) estimate that HMO enrollees if enrolled in the Medicare FFS program would cost 12% less than the average Medicare beneficiary. If true, then according to our calculations, under the current payment structure, the Medicare HMO program results in a net welfare loss. Riley *et al.* used data from the Fall 1994. Since then HMO enrollment has grown substantially, their estimate likely overstates the current cost differentials. Brown *et al.* (1993)

[18] In this calculation, we are assuming that the payments and benefits structure of the Medicare fee-for-service program are fixed.
[19] See, for example, "Medicare+Choice: Reforms have reduced, but likely not eliminated, excess plan payments," GAO Report HEHS-99-144.

estimate that a typical HMO enrollee would cost 10% than the average Medicare FFS beneficiary. Like Riley *et al.*, their work uses data from the early 1990s prior to the rise of Medicare HMOs. Rogers and Smith (1995) find no cost differential between the typical Medicare FFS enrollee and the average Medicare HMO enrollee. Finally, Dowd *et al*. (1996) analyze data from Minneapolis the late 1980s and they also find no evidence that Medicare HMOs attract a healthier population.

Next we turn our attention to analyzing the sensitivity of consumer welfare to changes in the CMS payment rate. Table 5 presents the censored regression estimation of the county-level, per capita consumer surplus on the CMS payment rate and the number of Medicare eligibles in the county.[20] The sample is divided by county size and the parameters are estimated separately for each sample as well as estimated over the entire sample of counties. The counties are divided into three categories: (large — over 15,000 enrollees, medium — between 5,000 and 15,000 enrollees and small counties — less than 5,000). We allow changes in the CMS payment rate to have dynamic consequences through the inclusion the lagged dependent variable. We estimate the parameters using the censored dependent variable, fixed effects with a lagged dependent variable procedure as proposed by Honore′ (1993). We estimate equations separately for each county category as the effective of the changes in the payment rate may vary by county size. The parameters are only identified for those counties that had at least one HMO operating in it for at least one year. Thus, the sample used to generate the parameter estimates is of those counties that had at least one HMO operating at some point during our sample time frame.

There are two particular questions that the parameters in Table 5 can help answer. First, do changes in the government payment rate affect total welfare or are they welfare neutral? At first blush, our intuition is that they should be welfare neutral as they can be viewed as simply a transfer payment from the government to the HMOs. However, the affect of changes in the payment rate will depend how firm behavior is affected by these changes. For example, high payment rates may result in HMOs to start offering benefits that are not highly valued by customers but are costly to provide. Conversely, increases in the payment rate could induce

[20] We also estimated specifications that allow for the payment rate to have a nonlinear impact on consumer surplus and found no evidence for the nonlinear specification.

HMOs to offer benefits that are valued to enrollees, enticing them to leave the costly fee-for-service program and enroll in a more efficient HMO.

The second question we seek to answer in Table 5 is: How do changes in the HMO payment rate affect the allocation of welfare between Medicare enrollees and HMOs? Most policymakers are not interested in increasing HMO welfare via the Medicare HMO program. In Table 5 we measure the impact of changes in the payment rate on consumer surplus. That is, do increases in the payment rate primarily increase HMO profits or does the competitive process translate changes in the payment rate into increases in consumer surplus?

The parameter estimates in Table 5 imply that changes in the CMS payment rate are not welfare neutral—increases in the payment rate are estimated to result in a welfare loss. Furthermore, changes in the payment rate disproportionately affect HMO profits relative to consumer surplus.

Across all size of counties, a $1 increase in the CMS payment rate is estimated to contemporaneous increase consumer surplus of $0.016 in the small counties, 0.017 in the medium sized counties and 0.020 in the large counties. The parameters are rather precisely estimated with the standard errors ranging from 0.001 to 0.002. The parameter estimates also show that there is some persistence in the impact of the payment rate upon consumer surplus. The coefficient on the lagged welfare is 0.36, 0.26 and 0.32 for the small, medium and large sized counties respectively. The dynamic consequences of a $1 increase in the payment rate on consumer surplus is therefore to result in a long run increase in consumer welfare of $0.024, $0.023 and $0.029 for the small, medium and large sized counties, respectively.

The impact in changes in the payment rate on total welfare varies considerably across the size of the county. In large counties, a $1 change in the payment rate is expected to increase total welfare $0.082 (s.e. = 0.010). In small counties the changes in the payment rate have virtually no expected impact on total welfare above their impact on consumer surplus.

In 1999, the HMO penetration rate is approximately 15.9% among the non-Medicaid, Medicare eligibles. This implies that a $1 across the board decrease in the payment rate would result save the government $0.16 per beneficiary assuming that HMO penetration is unaffected by changes in the payment rate. However, the payment rate does impact HMO penetration — we estimate that the HMO penetration rate elasticity is 2.5 for large counties and virtually zero for small ones. This implies that an increase in the payment rate by $1 will increase government expenditures by $0.64 for the large counties and by $0.10 for small counties. Thus, an increase in the payment level results in a welfare loss with the magnitude of that loss increasing in the size of the county. This result comes with an important caveat. As discussed earlier, our measure of plan profitability is likely downward biased and insofar as that bias is correlated with the payment rate, which is very likely, then we are underestimating the impact of changes in the payment rate on total welfare.

The large increase in consumer surplus over the 1990s is not driven by the increase in the payment rates. While the median real payment rate increased approximately 18% and per capita welfare increased 934% over the period, our estimates imply that they are largely causally unrelated. The increase in consumer surplus over this period is a result of Medicare enrollee's simply finding HMOs a more attractive option.

C. Simulating and Decomposing the Welfare Impact of Changes in the Payment Rate

To get a better sense of what drives the changes in consumer surplus associated with the changes in the CMS payment rate, we simulate the impact of changes in the payment rate on market and plan characteristics and then simulate the impact of the change in those characteristics on consumer and HMO welfare. We outlined our methodology for this simulation in Section 3.

Table 6 presents the GMM fixed-effects, Negative Binomial regression results of the number of plans operating in a county on the payment rate, the number of Medicare eligibles, the number of hospitals and the lagged number of plans. These regressions are performed separately for the different county size classes. The payment rate is positive and significant in most years for large counties. For the typical county, a $100 increase in the payment is expected to increase the number of plans operating in that county by 0.13. For the medium sized counties, the coefficient on the payment rate is only significant in 1996, while for the small counties the coefficient is never positive and significantly different from zero. These results suggest that using the payment rate to increase the number of Medicare HMO plans in a county is not likely to be successful. It is also noteworthy that these estimates are markedly different from Cawley, Chernew, and McLaughlin (2001) who use a random-effects framework to estimate a much large price sensitivity of the number of plans operating in a county to changes in the payment rate.

Table 7 presents the parameter estimates of equations (7a)-(7c), the payment rate, plan and market characteristics on the plan premium, prescription drug coverage, and $\hat{\xi}$. These regressions are done separately for each county size category.

Several results from Table 7 deserve mentioning. Increases in the payment rate decrease the expected premium. The coefficients on the CMS payment are negative in all three premium regressions. Increases in the number of competitors in a county decrease the expected premium and this effect is more pronounced if the competitors are in the same "drug" nest. The provision of drug coverage increases the expected premium between \$57 and \$68 for the monopoly plan depending on the size of the county.

Increases in the payment rate increases the likelihood that the plan will offer drug benefits. For the typical plan, a \$1 increase in the payment rate will increase the probability that they will offer drug benefits, conditional on them not offering them in the previous period, by approximately 0.0025. The only market structure variable that affects the likelihood of offering drug benefits is the number of competitors who also offer drug benefits in the medium and large counties. Drug benefits are sticky. That is, if a plan offers them they tend to offer them into the future.

Estimated unobserved quality, $\hat{\xi}$, is also positively impacted by the CMS payment rate in medium and large counties. Increases in the amount of direct (within nest) competition faced by a firm increases their expected $\hat{\xi}$. Plans that offer drug benefits have a lower significantly lower plan quality. Like drug benefits, there is also significant persistence in unobserved plan quality over time.

We use the estimates from Tables 6 and 7 to simulate the impact of a 10% increase in the CMS payment on plan characteristics and welfare. We are also interested in decomposing the welfare effects of the increase in payments into different components. Specifically, we wish to separate out the payment impacts into a premium effect, a drug benefit effect, an unobserved quality impact, and a number of plans impact. To perform these decompositions we calculate the expected change in the variable of allowing the other characteristics to vary in response to the change in the variable of interest holding the payment effects constant for the other characteristics. Once the new characteristics have been calculated, it is straightforward to compute the resulting welfare effects. The results presented here are based on 250 simulation draws.

Table 8 presents the means of the simulation across all counties and by county size category. With the exception of the small counties, the simulated impact on consumer surplus of an increase in the payment rate roughly corresponds to the reduced form estimates presented in Table 5. A $1 increase in the payment is expected to increase consumer surplus $0.016, $0.017 and $0.02 for small, medium and large counties respectively. In the simulation we are performing a slightly different experiment by increasing the payment rate by 10%, which translates into a mean payment increase of $37, $40 and $45 for the three county categories, respectively. The respective predicted increase in consumer surplus is approximately $0.59, $0.68, and $0.90. The simulated increase in consumer surplus is: 0.01, 0.54, and 0.92. However, the estimated increase in profits is much greater in the simulation than in the reduced form estimation. This is likely due to our underestimating the HMO profits for those HMOs that charge a zero premium. For this reason, we put more faith in the change in profitability estimates from the simulation as they only rely on two key estimates: the marginal cost of drug benefits is $51 and the cost of increasing ξ is $8.

The simulations also imply a significant welfare loss to increasing the payment rate. A 10% increase in the payment rate is expected to result in a per-beneficiary loss of approximately $6 per month. This translates into an annual welfare loss of $2.8 billion on an increased government expenditure of $10.4 billion. The magnitude of the loss and the percentage of the loss relative to government expenditures increases with county size. For small counties the simulated percent loss in welfare for every dollar increase in government expenditure is 2.2%, while the same figure is 25%.

The source of the consumer surplus gains are relatively evenly distributed across the different market/product characteristics.[21] For the entire sample, the largest gains that result from an increase in the payment appear to associate with decreases in the premium. There is relatively little increase associated with offering drug benefits as add drug benefits increases the expected premium which offsets the substantial benefits of drug coverage.

In Table 9 we present the simulations results broken down by the number of plans in a county. These results indicate that the welfare loss increases with the number of plans. Interesting, expected total welfare increases with an increase in the payment rate in monopoly plan counties. The magnitude of the consumer surplus gains increase with county size. However, the ratio of the increase of Medicare beneficiary surplus to HMO profits decreases in the number of plans operating in a county. Aggregate HMO welfare also follows a similar pattern. The magnitude of the increase in profitability increases with the number of plans, however the ratio of profits to welfare loss decreases with county size. Finally, the ratio of the increase in consumer plus producer surplus divided by the increase in government expenditures associated with increasing the payment rate is decreasing in the number of plans operating in a county.

6. Conclusions

In this paper we estimate the welfare associated with the Medicare HMO program, now known as Medicare+Choice. In addition, we estimate the relationship between per capita consumer surplus and changes in the CMS payment rate. Finally, we simulate and decompose per capita consumer surplus into the benefits associated with changes in the number HMOs offering a product and the benefits offered by the HMOs.

We find that the Medicare HMO program contributed over $1.5 billion of consumer surplus and 4.5 billion in HMO profits from 1993 to 1999. We estimate that the HMO program generate societal welfare gains if as long as the cost of treating the HMO enrollees in the Medicare FFS plan is not less than 96% of the payments the government has paid to HMOs. We find that per

[21] It is important to note that because of the nonlinearlity of the welfare calculation the sum of the decomposed welfare elements will not necessarily add up to welfare accounting for the change in all of the characteristics.

capital welfare is insensitive to changes in the CMS payment rate. A $1.00 increase in the CMS payment (which will cost the government $0.52 per Medicare enrollee corresponding to the Medicare HMO penetration rate in 1999) will generate a $0.02 per capita increase in consumer surplus for Medicare beneficiaries.

While the M+C program generated significant consumer surplus, our estimates suggest that the program likely reduced total societal welfare. This is statement is certainly true if we exclude HMO profits from the welfare calculations. The reason that the M+C program is unable to generate significant welfare gains is straightforward. The Medicare fee-for-service program, the outside good in our analysis is a very attractive option for seniors. These results suggest that it is difficult to run market-based programs that are welfare increasing when there is an attractive, government subsidized option.

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Table 1

Summary Statistics

(standard deviation in parentheses)

Variable	1993	1999
Average Number of Plans Per County	0.36	0.87
Percent of Counties with At Least One HMO	20.1%	31.2%
Average Number of Enrollees per Plan	1,535 (5,995)	2,272 (5,064)
Percent of Plans offering Drug Coverage	44.6%	80.0%
Average Premium	$32.64 ($34.53)	$8.09 ($18.11)
Percent of Plans Charging Zero Premium	36.1%	78.8%
Mean Medigap Premium	$84.0 (15.0)	$117.0 (19.4)
Mean Medicaid Enrollment Rates for Medicare Eligibles	10.5%	10.4%
CMS Payment Quartiles	$291, $328, $373 (68.3)	$369, $388, $442 (63.3)
HMO Medicare Penetration	4.8%	15.7%
Total Number of County/Plans Observations	1,167	2,772
Number of Counties	3,208	3,208

Note: Dollar figures are in 1998 Dollars.

Table 2

Fixed Effects, Instrumental Variable Estimates of the Parameters of the Utility Function

Parameter	Dependent Variable is $\ln(s_{jt}) - \ln(s_{0t})$				
	F.E. IV Nested Logit — Benefit offering Endogenous (1)	F.E. IV Nested Logit — Benefit offering Endogenous (2)	F.E. IV Logit — Benefit offering Endogenous (3)	F.E. IV Nested Logit — Benefit offering Exogenous (4)	F.E. OLS Logit (6)
Premium	-0.043 (0.017)	-0.027 (0.0097)	-0.018 (0.0072)	-0.020 (0.0078)	-0.0052 (0.00044)
Medigap Premium	0.019 (0.0066)	0.014 (0.0043)	0.010 (0.0032)	0.0077 (0.0024)	-0.0012 (0.00094)
Drug Coverage	3.99 (1.13)	3.17 (0.65)	1.81 (0.42)	-0.091 (0.069)	0.052 (0.021)
Log of Within Drug Category Market Share	0.63 (0.22)	0.67 (0.22)	—	0.31 (0.091)	0.40 (0.0071)
Logarithm of Number of Plans	-0.66 (0.55)	—	—	0.42 (0.12)	0.50 (0.024)
Constant	-5.52 (0.93)	-6.12 (0.69)	-6.44 (0.53)	-5.39 (0.41)	-5.15 (0.12)
Std. Dev. of ξ_{jm}	2.54	2.09	2.02	1.53	1.40
Std. Dev of e_{jmt}	1.58	1.27	0.97	0.69	0.64
N	13,267	13,267	13,267	13,267	13,267

Note: The instrument set is described in Section 3. Annual dummies are included as independent variables.

Table 3

Monthly Consumer Surplus, HMO penetration, and Percentage of Plans Offering Drug Benefits by Number of HMOs Operating in the County in 1999

Number of Plans	Mean Per Capita Consumer Surplus ($)	Mean HMO Penetration (%)	Mean Percent of Plans offering Drug Benefit	Number of Counties	Total Number of Medicare Beneficiaries (millions)
0	0	0	—	2,071	10.4
1	0.03	2.7	43.3	357	3.2
2	0.10	7.8	57.9	268	3.1
3	0.19	12.6	58.3	146	2.9
4	0.34	15.9	59.6	105	2.9
5	0.64	20.7	68.7	71	2.6
6	0.81	24.8	60.5	49	2.6
7	2.03	24.6	64.6	27	1.4
8	0.94	28.6	64.3	20	1.4
9	1.80	24.1	79.7	17	1.8
10	1.57	25.3	72.3	13	1.8
11	2.10	30.1	75.8	3	0.4
12	4.10	29.8	83.3	6	1.3
13	1.97	29.1	61.5	5	0.7
14	3.07	42.3	71.4	4	0.9

Note: Dollar figures are in 1998 Dollars.

Table 4

Estimated Aggregate Consumer Surplus and Total Government Expenditures
on Medicare HMO Enrollees by Year—
Ackerberg—Rysman Nested Logit Model

Year	Total Consumer Surplus ($ Millions)	Mean Annual Consumer Surplus Per Medicare Beneficiary ($)	Total Estimated Profits (P-MC) ($ Millions)	Total CMS Expenditures on Medicare HMO Enrollees ($ Millions)	Number of Medicare Beneficiaries Enrolled in an HMO (Millions)
1993	44.2	1.32	86.2	10,963.5	1.79
1994	70.3	2.11	84.5	13,800.0	2.27
1995	117.0	3.40	302.6	19,227.1	3.12
1996	212.3	6.10	695.4	26,588.7	4.72
1997	295.4	8.38	1,115.9	34,188.1	5.28
1998	335.7	9.44	930.0	37,658.7	5.92
1999	455.9	12.69	1,285.8	39,748.2	6.30
Undiscounted Sum	1,530.8	---	4,500.4	141,190	---

Figures are in 1998 dollars

Table 5

GMM Fixed Effects, Tobit Estimates of the effects of the CMS Payment Rate on Per Capita Consumer Surplus and Per Capita Total Welfare
(standard errors in parentheses)

Independent Variables	Small Counties—Medicare Eligible Population < 5,000		Medium Counties—Medicare Eligible between 5,000 and 15,000		Large Counties—Medicare Eligible Population >15,000	
	Consumer Surplus	Total Welfare	Consumer Surplus	Total Welfare	Consumer Surplus	Total Welfare
CMS Payment	0.016 (0.0010)	0.017 (0.0034)	0.017 (0.00071)	0.026 (0.0046)	0.020 (0.0020)	0.082 (0.010)
CMS Payment $\times$Time	0.00014 (0.00014)	0.00009 (0.00038)	0.00055 (0.00011)	0.0016 (0.00040)	0.00044 (0.00029)	-0.00009 (0.00046)
Time	0.14 (0.061)	-0.017 (0.13)	0.01 (0.019)	-0.69 (0.15)	-0.003 (0.16)	-0.38 (0.28)
Number of Medicare Eligibles	0.00071 (0.000021)	0.00054 (0.00038)	0.00014 (0.000025)	0.00014 (0.00008)	0.0002 (0.000026)	-0.00094 (0.00046)
Lagged Welfare	0.37 (0.034)	0.23 (0.024)	0.26 (0.020)	0.20 (0.017)	0.32 (0.035)	0.20 (0.022)
J-statistic (p-value)	58.7 (0.0)	60.3 (0.00)	77.0 (0.0)	66.1 (0.01)	116.2 (0.0)	91.2 (0.0)
N	2,394	2,394	1,890	1,890	2,142	2,142

Table 6

GMM, Fixed Effects Estimates of the effects of the CMS Payment Rate on the Number of Plans
(standard errors in parentheses)

Independent Variables	Small Counties—Medicare Eligible Population < 5,000	Medium Counties—Medicare Eligible between 5,000 and 15,000	Large Counties—Medicare Eligible Population >15,000
CMS Payment $\times$Year95	-0.00082 (0.0010)	-0.00036 (0.0018)	0.000011 (0.00098)
CMS Payment $\times$Year96	0.00057 (0.00095)	0.0017 (0.00090)	0.0023 (0.0010)
CMS Payment $\times$Year97	-0.00018 (0.00095)	0.0010 (0.0010)	0.0046 (0.0012)
CMS Payment $\times$Year98	-0.0020 (0.0012)	-0.00085 (0.0016)	0.00026 (0.0015)
CMS Payment $\times$ Year99	-0.0023 (0.0013)	-0.00012 (0.0018)	0.00027 (0.00012)
Number of Medicare Eligibles	0.00072 (0.00031)	-0.00012 (0.00010)	-0.00008 (0.00018)
Number of Hospitals	-0.39 (0.15)	0.065 (0.12)	0.18 (0.034)
Lag Number of Plans	1.22 (0.10)	0.91 (0.13)	0.46 (0.080)
J-statistic $\chi^2(14)$	54.7 (0.0)	53.4 (0.0)	174.1 (0.0)
N	2,219	1,983	1,913

Table 7

Conditional Fixed Effects, Tobit Estimates of the effects of the CMS Payment Rate on Per Capita Consumer Surplus and Per Capita Total Welfare
(standard errors in parentheses)

Independent Variables	Dependent Variables, Estimation Method, and List of Lagged Independent Variables								
	Premium			Drugs			$\hat{\xi}$		
	Chamberlain (1982) Tobit			Chamberlain (1982) Logit			Arellano and Bond (1991)		
	All Independent Variables Contemporaneous			Lagged Variables: Premium, Eta and Drugs			Lagged Variables: Premium and Eta		
	Small Counties	Medium Counties	Large Counties	Small Counties	Medium Counties	Large Counties	Small Counties	Medium Counties	Large Counties
CMS Payment	-0.065 (0.041)	-0.10 (0.031)	-0.20 (0.021)	0.019 (0.004)	0.022 (0.004)	0.014 (0.0020)	0.0010 (0.0018)	0.0041 (0.0008)	0.0011 (0.0004)
Number of Competitors	-3.85 (5.91)	-2.21 (3.82)	-13.52 (1.46)	0.47 (0.54)	0.30 (0.55)	0.058 (0.17)	0.17 (0.17)	0.25 (0.17)	0.36 (0.060)
Monopoly Plan	-1.22 (1.58)	17.75 (12.63)	-24.75 (12.65)	0.66 (1.53)	3.36 (1.62)	-0.84 (1.27)	-0.55 (0.62)	-0.32 (0.63)	-0.34 (0.10)
Payment × Number of Competitors	-0.0035 (0.013)	-0.0031 (0.0086)	0.022 (0.0028)	-0.14 (0.12)	-0.18 (0.12)	-0.00092 (0.00032)	-0.0049 (0.037)	-0.0002 (0.0004)	-0.0007 (0.0002)
Payment × Monopoly Plan	0.073 (0.036)	0.018 (0.031)	0.10 (0.029)	-0.0001 (0.003)	-0.008 (0.0038)	0.0021 (0.0034)	0.0010 (0.0015)	-0.0041 (0.0015)	-0.0002 (0.001)
Number of Competitors offering Drug Benefits	8.74 (1.93)	2.11 (1.19)	2.86 (0.61)	-0.17 (0.16)	0.26 (0.15)	0.32 (0.054)	-0.18 (0.052)	-0.29 (0.039)	-0.10 (0.015)
Drugs×Monopoly Plan	-14.97 (1.52)	-14.23 (3.01)	-5.06 (3.53)	—	—	—	-0.19 (0.16)	0.25 (0.15)	-0.38 (0.17)
Drugs	81.23 (3.24)	71.68 (3.69)	73.49 (2.71)	5.02 (0.42)	4.45 (0.33)	4.65 (0.19)	-4.35 (0.060)	-4.86 (0.089)	-4.82 (0.048)
Drugs× Number of Competitors offering Drug Benefits	-14.59 (1.52)	-7.79 (1.12)	-6.51 (0.39)	—	—	—	0.34 (0.049)	0.44 (0.046)	0.15 (0.011)
$\hat{\xi}$	20.12 (1.01)	17.71 (0.83)	18.73 (0.50)	0.70 (0.10)	0.77 (0.083)	0.64 (0.052)	0.24 (0.016)	0.30 (0.027)	0.28 (0.015)
Number of Medicare Eligibles	0.005 (0.002)	0.003 (0.0001)	-0.00001 (0.00002)	0.0007 (0.0002)	0.00008 (0.0001)	0.00001 (0.01)	0.00005 (0.00002)	0.000001 (0.00001)	0.000001 (0.00001)
Obj. Function N	-5,473 2,632	-7,759 3,238	-14,385 7,396	-476 1,872	-580 2,302	-1,380 6,080	45.9 1,092	21.7 1,604	158.9 4,239

Table 8

Simulated Impact of Increasing the HMO payment by 10 Percent
(Across plan/county standard deviations of in parentheses)

	Entire Sample	Small Counties Medicare Eligible Population < 5,000	Medium Counties Medicare Eligible between 5,000 and 15,000	Large Counties Medicare Eligible Population >15,000
Initial Mean Per-capita Consumer Surplus	0.52 (0.42)	0.015 (0.23)	0.040 (0.29)	0.73 (0.97)
Post-Simulation Mean Per-capita Consumer Surplus	0.92 (1.03)	0.024 (0.20)	0.58 (1.30)	1.65 (1.91)
Post-Simulation Mean Consumer Surplus—Drug effects only	0.61 (0.72)	0.021 (0.16)	0.049 (0.30)	0.91 (1.14)
Post-Simulation Mean Consumer Surplus—Eta effects only	0.62 (0.46)	0.018 (0.16)	0.049 (0.24)	0.86 (1.10)
Post-Simulation Mean Consumer Surplus—Premium effects only	0.71 (0.70)	0.016 (0.16)	0.045 (0.24)	1.00 (1.36)
Post-Simulation Mean Consumer Surplus—Number of Plans effects only	0.55 (0.57)	0.015 (0.23)	0.41 (0.36)	0.86 (1.11)
Change in Per-Capita Profits	15.68	0.89	4.31	22.27
Increase in Per-Capita Contemporaneous Government Spending	21.60	0.91	5.29	29.47

Plan / County Characteristics

	Small Counties		Medium Counties		Large Counties	
	Initial	Post-simulation	Initial	Post-simulation	Initial	Post-simulation
Number of Plans	0.33	0.33	0.85	0.90	3.27	3.33
Premium	10.45 (19.55)	9.69 (19.11)	13.67 (21.35)	13.46 (21.35)	10.35 (19.40)	7.83 (16.29)
Drugs	0.70	0.72	0.64	0.66	0.74	0.76
Normalized Eta	-10.72 (4.12)	-10.68 (4.01)	-9.43 (3.86)	-9.24 (3.94)	-9.47 (2.04)	-9.40 (3.39)
Number of Plans Number of Counties	598 1,832		732 869		1,642 506	

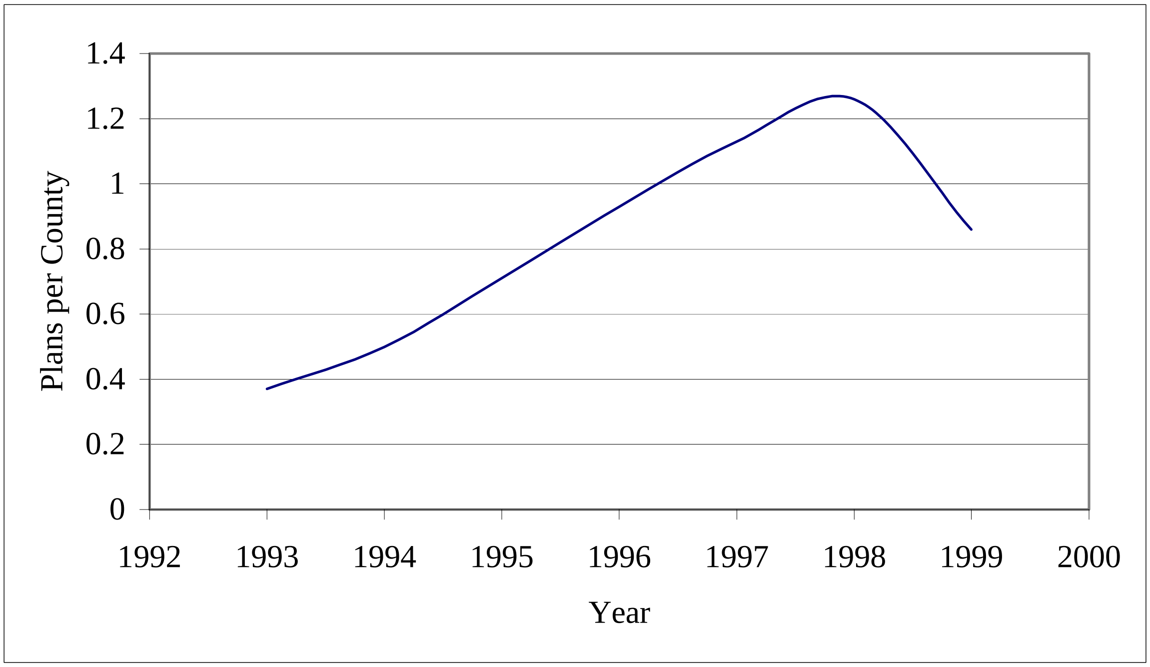
Table 9

Simulated Impact of Increasing the HMO payment by 10 Percent
On Total Welfare, Consumer Surplus, and Profits by Number of Plans Operating in the County 1997 Base

Initial Number of Plans	Mean Across Simulations				
	Δ Welfare	Δ CS	$\Delta\pi$	Entry Probability	N
0	-0.084	0.000017	0.045	0.015	2,175
1	0.048	0.36	2.49	0.030	376
2	-0.98	0.64	8.31	0.037	253
3	-1.94	0.97	13.45	0.051	127
4	-2.88	0.95	17.03	0.049	78
5	-4.52	1.30	23.09	0.059	55
6	-6.98	1.67	28.74	0.064	51

Figure 1

Average Number of Plans Per County Per Year



Appendix

Table A1

Estimated Aggregate Consumer Surplus and Total Government Expenditures
on Medicare HMO Enrollees by Year
—Standard Nested Logit Model

(Standard Errors of Estimates in Parentheses)

Year	Total Consumer Surplus ($ Millions)	Mean Annual Consumer Surplus Per Medicare Beneficiary ($)	Total Estimated Profits (P-MC) ($ Millions)	Total CMS Expenditures on Medicare HMO Enrollees ($ Millions)	Number of Medicare Beneficiaries Enrolled in an HMO (Millions)
1993	43.2	1.29	95.6	10,963.5	1.79
1994	72.4	2.18	114.4	13,800.0	2.27
1995	127.1	3.70	357.8	19,227.1	3.12
1996	255.2	7.33	759.4	26,588.7	4.72
1997	361.0	10.24	1,188.5	34,188.1	5.28
1998	412.1	11.52	998.5	37,658.7	5.92
1999	579.4	16.13	1,332.3	39,748.2	6.30
Undiscounted Sum	1,850.4	---	4,847.2	141,190	---

Figures are in 1998 dollars

Table A2

Monthly Consumer Surplus, HMO penetration, and Percentage of Plans Offering Drug Benefits by Number of HMOs Operating in the County in 1999
—Standard Nested Logit Model

Number of Plans	Mean Per Capita Consumer Surplus ($)	Mean HMO Penetration (%)	Mean Percent of Plans offering Drug Benefit	Number of Counties	Total Number of Medicare Beneficiaries (millions)
0	0	0	—	2,071	10.4
1	0.03	2.7	43.3	357	3.2
2	0.10	7.8	57.9	268	3.1
3	0.19	12.6	58.3	146	2.9
4	0.34	15.9	59.6	105	2.9
5	0.62	20.7	68.7	71	2.6
6	0.73	24.8	60.5	49	2.6
7	1.61	24.6	64.6	27	1.4
8	0.84	28.6	64.3	20	1.4
9	1.55	24.1	79.7	17	1.8
10	1.31	25.3	72.3	13	1.8
11	1.70	30.1	75.8	3	0.4
12	3.08	29.8	83.3	6	1.3
13	1.69	29.1	61.5	5	0.7
14	2.43	42.3	71.4	4	0.9

Note: Dollar figures are in 1998 Dollars.